

Application No. 10/708,020
Technology Center 1775
Amendment dated April 26, 2007
Reply to Office Action dated February 5, 2007

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Currently amended): A thermal barrier coating system on a surface of a component, substrate; the thermal barrier coating system comprising:

a bond coat on the surface of the component; substrate;

an alumina scale on the bond coat; and

a multilayer thermal barrier coating consisting of:

a thermal-sprayed first ceramic layer on the alumina scale, the first ceramic layer consisting essentially of partially stabilized zirconia so as to comprise the tetragonal and cubic phases of zirconia, the first ceramic layer being essentially free of vertical microcracks; -and-

a thermal-sprayed noncolumnar second ceramic layer overlying the first ceramic layer and being the outermost layer of the

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thermal barrier coating system and defining the outermost surface of the component, the second ceramic layer having a thickness greater than the first ceramic layer, the second ceramic layer consisting essentially of fully stabilized zirconia so as to consist essentially of the cubic phase of zirconia, the fully stabilized zirconia of the second ceramic layer being less erosion resistant than the partially stabilized zirconia of the first ceramic layer, the second ceramic layer being in an as-thermal sprayed condition to have a microstructure characterized by irregular flattened grains and a degree of inhomogeneity and porosity, and to have vertical microcracks that extend through the thickness of the second ceramic layer in an amount of at least twenty-five cracks per linear inch of surface thereof to cause the second ceramic layer to be more erosion resistant than the first ceramic layer; and

optionally one or more intermediate layers between the first and second ceramic layers, the one or more intermediate layers providing a compositional gradient between the first and second ceramic layers whereby concentrations of partially and fully-

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stabilized zirconia decrease and increase, respectively, in the direction toward the second ceramic layer, wherein in the absence of the one or more intermediate layers the second ceramic layer overlies and contacts the first ceramic layer.

Claim 2 (Original): The thermal barrier coating system according to claim 1, wherein the bond coat is an overlay coating.

Claim 3 (Original): The thermal barrier coating system according to claim 2, wherein the bond coat is an MCrAlX overlay coating.

Claim 4 (Original): The thermal barrier coating system according to claim 1, wherein the first ceramic layer consists of zirconia, at least one stabilizer, and incidental impurities.

Claim 5 (Original): The thermal barrier coating system according to claim 4, wherein the stabilizer is yttria in an amount of about 7 to about 8 weight percent of the first coating layer.

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Claim 6 (Original): The thermal barrier coating system according to claim 1, wherein the second ceramic layer consists of zirconia, about 18 to about 20 weight percent of yttria as a stabilizer, and incidental impurities.

Claim 7 (Original): The thermal barrier coating system according to claim 1, wherein the first ceramic layer is an air plasma sprayed layer.

Claim 8 (Original): The thermal barrier coating system according to claim 1, wherein the first and second ceramic layers are plasma sprayed layers.

Claim 9 (Currently amended): The thermal barrier coating system according to claim 1, wherein the first and second ceramic layers have a combined thickness of at least ~~about 250 to about 2000~~ micrometers.

Claim 10 (Original): The thermal barrier coating system according to claim 9, wherein the first ceramic layer has a thickness of about 25 to about 250 micrometers.

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Claim 11 (Original): The thermal barrier coating system according to claim 9, wherein the second ceramic layer has a thickness of about 125 to about 2000 micrometers.

Claim 12 (Original): The thermal barrier coating system according to claim 9, wherein the first and second ceramic layers have a combined thickness of at least 500 micrometers.

Claim 13 (Canceled)

Claim 14 (Currently amended): The thermal barrier coating system according to claim 1, wherein the component is ~~substrate is a surface region of~~ a gas turbine engine component.

Claim 15 (Original): The thermal barrier coating system according to claim 14, wherein the gas turbine engine component is a combustor liner.

Claim 16 (Original): The thermal barrier coating system according

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to claim 14, wherein the gas turbine engine component is a turbine shroud.

Claim 17 (Currently amended): A thermal barrier coating system on a surface of a gas turbine engine component, the thermal barrier coating system comprising:

an overlay bond coat on the surface of the component; ~~substrate~~;

an alumina scale on the bond coat; and

a multilayer thermal barrier coating consisting of:

a plasma-sprayed first ceramic layer on the alumina scale, the first ceramic layer consisting essentially of zirconia partially stabilized by about 7 to about 8 weight percent yttria so as to comprise the tetragonal and cubic phases of zirconia and so as to have a phase transformation temperature, the first ceramic layer being essentially free of vertical microcracks; and

a plasma-sprayed noncolumnar second ceramic layer on and contacting the first ceramic layer and being the outermost layer of the thermal barrier coating system and defining the outermost surface of the component, the second ceramic layer consisting

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essentially of zirconia fully stabilized by about 18 to about 20 weight percent yttria so as to consist essentially of the cubic phase of zirconia, the fully stabilized zirconia of the second ceramic layer being less erosion resistant than the partially stabilized zirconia of the first ceramic layer, the second ceramic layer being in an as-plasma sprayed condition to have a microstructure characterized by irregular flattened grains and a degree of inhomogeneity and porosity, and to have vertical microcracks that extend through the thickness of the second ceramic layer in an amount of at least twenty-five cracks per linear inch of surface thereof to cause the second ceramic layer to be more erosion resistant than the first ceramic layer;
wherein the first and second ceramic layers have a combined thickness of about 500 to about 2000 micrometers, the first ceramic layer has a thickness of up to about 125 micrometers, and the second ceramic layer is thicker than the first ceramic layer.

Claim 18 (Original): The thermal barrier coating system according

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to claim 17, wherein the gas turbine engine component is subjected to an operating temperature at which the first ceramic layer sustains maximum temperatures below the phase transformation temperature thereof and the second ceramic layer sustains maximum temperatures above the phase transformation temperature of the first ceramic layer.

Claim 19 (Original): The thermal barrier coating system according to claim 17, wherein the gas turbine engine component is a combustor liner.

Claim 20 (Original): The thermal barrier coating system according to claim 17, wherein the gas turbine engine component is a turbine shroud.